Geol. Survey

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
STATE GEOLOGICAL SURVEY DIVISION

Morris M. Leighton, Chief

PITTSFIELD AREA

Pike County

Guide Leaflet 51-D

By
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PITTSFIELD AREA

ITINERARY

(Pittsfield, Griggsville, Pearl, and Nebo Quadrangles)

0.0		Caravan assembles west of Pittsfield High School, headed south on gravel road.
0.0	0.0	Start. Turn left (E) onto Adams Street.
0.2	0.2	Stop sign. Memorial Street. Continue ahead (E)
0.1	0.3	Stop sign. Madison Street on square. Continue ahead (E).
0.1	0.4	Stop sign. Jefferson Street. Turn right (S).
0.1	0,5	Stop sign. Route 54. Continue ahead (S) across Route 54.
0.2	0.7	Turn left (E).
0.1	0.8	Turn right (S). Route passes into open country and traverses a rather gently rolling upland. No bedrock is to be seen because a thick mantle of loose material here lies on a relatively level bedrock surface. This buried surface is known as the Calhoun (Lancaster) Peneplain.

The Calhoun peneplain is the result of erosion which stripped away former bedrock deposits down to a height of from 650 to 750 feet above present sea level. When the peneplain was developed, however, sea level was much higher than it is today, so that stream erosion was unable to cut below the present 650 feet level. Later, the region was uplifted several hundred feet and the streams deepened their valleys, excavating them well below the old peneplain surface.

The loose material that mantles the peneplain is made up in large part of loess, a fine powdery silt that was picked up by the winds of the Ice Age as they blew across the barren Mississippi River flats, and dropped the dust over the uplands to the east.

Beneath the main body of the loess there are patches of glacial till dropped by the Kansan Ice sheet when it melted away early in the Pleistocene Period ("Ice Age"). This till because of its great age, is deeply weathered to a "gumbotil".

1.6	2.4	Turn left (E) along power line.

2.6 5.0 Turn right (S) with main road.

1.6 6.6 Turn left (E).

1.7 8.3 Jog right and left in TIME and continue east.

1.0 9.3 STOP NO. 1. Cross Bay Creek. For over 20 miles, the upper course of Bay Creek lies just in front (SE) of the southwest edge of Illinoian glaciation. It seems probable that originally much of this country drained to the Illinois valley to the east. The Illinois Glacier blocked these outlets. Therefore, it is quite logical to assume that for a time small lakes occupied the valley heads. The levels of these lakes rose until they spilled over the divides separating them; the streams linking the lakes eventually drained them by cutting down the divides, and finally a continuous stream valley (Bay Creek) was formed.

0.4 9.7 Cross Bay Creek.

0.6 10.3 Highway turns left (N) and ascends hill.

0.3 10.6 Highway turns right (E).

0.7 11.3 STOP NO.2. Summit of terminal moraine of Illinoian glacier, part of a low broad ridge of glacial till aligned parallel with the ice front and rising about 100 feet higher than the uplands to east and west.

When the edge of a living glacier remains stationary for a long time this means that the rate of melting back of the ice is about equal to the forward motion of the ice. As the ice moved forward continuously, to melt along this line, it continually dropped here large quantities of earth and stone. When the ice finally retreated, a broad, low ridge of accumulated earth and rock was left behind. Such a ridge is called a terminal moraine.

The country west of this ridge experienced only one glaciation, the Kansan; the country to the east was glaciated in Illinoian, as well as in the earlier, Kansan, time.

0.9 12.2 Enter MILTON.

0.4 12.6 Stop sign. Turn right (S) on Route 100. Note ridge to west (right) marking the Illinoian terminal moraine.

3.4 16.0 Next half mile is in rugged country, dissected in post-Illinoian time by headwaters of Buckhorn Creek. Cherty limestone

exposed in cuts is bedrock of Mississippian, Burlington age.

3.3 19.3 Descend hill to valley of Hill Creek.

0.7 20.0 Underpass. Gulf, Mobile, and Ohio Railroad.

0.8 20.8 Enter PEARL through levee, erected to shut out back water of Illinois River floods.

0.4 21.2 Cross bridge. Turn left at Skelly Station, onto gravel road along crest of levee.

0.3 21.5 DANGER. Turn left across creek, take left fork, and cross railroad. (Right fork goes to river ferry).

0.2 21.7 Turn left off road on to drive ascending to quarries.

0.1 21.8 STOP NO.3. Go left (SW) to large limestone quarry. This quarry is entirely in the Mississippian, Burlington limestone, and nearly the full thickness of that formation is exposed here. Note the thick layers and the horizontal, parallel bedding planes separating the layers. This latter character suggests deposition in a large body of standing water, and a study of the fossils indicates these waters were marine. The fossils also show that the rock formed in marine waters over 250,000,000 years ago, at a time when a great embayment of the sea covered much of the Mississippi Valley.

Not only are many excellent fossils to be found in the limestone, but a close examination of most of the beds will show that this limestone is made up largely of the ground up remains of fossil shells, especially of the plates and stem segments of fossil crinoids, for which Burlington limestone is well known the world over. These crinoids or "sea lilies" are not plants, but invertebrate animals related to the starfish. A crinoid may be said to be a starfish with its arms folded to form a cup (or "calyx"), with the base of the cup attached to the sea bottom by a long, jointed stem ("Indian beads"). Each plate and stem of the crinoid is a single crystal of lime carbonate, or "calcite".

A formation of lime carbonate (limestone) is subject to ready solution by rain waters descending into the earth along the joints and crevices present in all such formations. In time these crevices may be widened by this dissolving action and develop into caverns. In places along these solution channels, the waters redeposit lime carbonate as "Mexican onyx" or "cave onyx". Great masses of cave onyx may be observed along the west end of the quarry wall.

The small caverns exposed in quarrying are not to be confused with the gallery of rock chambers entered through the portal of the causeway. These were man-made in the process of quarrying out a 20-foot bed of limestone nearly free of chert.

This chert is common about the quarry as large rounded nodules or shattered masses of white, brittle, hard rock. The chert originated at the same time as, or shortly after, the deposition of the limestone, but explanation of the precise manner of formation is still a controversy. The chert, being insoluble silica, is a detriment to agricultural lime production.

0.0 21.8 Return to parking area and continue on foot beyond, to north quarry, -

STOP NO. 4. This quarry is also in the Burlington limestone, but, going lower, shows the contact between the Burlington limestone and the underlying Hannibal (Kinderhook) shale. Note that the limestone and shale bedding planes are parallel and that the line separating the two formations is regular and continuous, such a relation geologists call a conformable contact.

This strongly suggests that, in spite of the difference in the nature of the rock, the waters were continually present and there was no interruption in the deposition of sediment. There appears to have been a sudden change from the muddy waters of the Hannibal to clear waters in which the very pure Burlington limestone was laid down. Very few forms of life cared to live in the muddy waters and we find few fossils in the Hannibal shale.

The quarry face here is in places coated with cave onyx and growths of small stalactites and stalagmites of the same material. This indicates a cavern crevice of considerable size has been exposed in quarrying.

0.0 21.8 At south end of quarry pick up trail that ascends bluff to right of powder house.

STOP NO. 5. Summit of Illinois River bluff above quarry.

We are overlooking the Illinois Valley, which, until the coming of the Illinois glacier from the northeast, was the valley of the Mississippi River. The river originally entered the state above Galena as it does today, but above Moline it swung eastward past Princeton to Bureau, and thence down the valley of the present Illinois.

The advance of the Illinoian glacier from the northeast to about the line of the present Mississippi, displaced the river which cut a new course about where it runs today. When the Illinoian glacier melted away, the Mississippi returned once again to its original course. But in the next, or Wisconsin stage of glaciation, an arm of the ice again crossed the Mississippi

between Moline and Fulton and again the river was displaced back into its western channel. This time it did not return to its original valley and today still follows the "detour" constructed during the time of Illinoian glaciation.

The Illinois river also has had a spectacular past. Great torrents poured down this valley at a time when the glacier was melting rapidly in the region south of Lake Michigan. The waters from the melting ice poured into the Illinois via the Kankakee River, from which they take the name of "The Kankakee Torrent".

Later in the Wisconsin stage of glaciation, the glacier retreated from the southern part of the Lake Michigan basin where Lake Michigan's ancestor, Lake Chicago, occupied the depression. But, with the glacier in the upper end of the lake basin, the waters could not escape to the St. Lawrence as they do today. The lake therefore spilled over to the southwest down the Des Plaines into the Illinois and past our present lookout.

Fur traders and explorers portaged their canoes over the low divide between the Chicago and the Des Plaines, as did the Indians before them, and found their way to the Mississippi. Finally in our own day, the Chicago Sanitary and Ship canal was dug along the old glacial channel and today a part of Lake Michigan's water again finds its way down the Illinois to the Mississippi.

0.0	21.8	Return to cars and reverse route to Skelly Station.
0.6	22.4	Stop sign. Turn right (W) on Route 100.
1.2	23.6	Underpass. G.M. & B. Railroad.
0.2=	23.8	CAUTION. Turn left (W) at base of hill, onto side road, and ascend valley of Hill Creek. Contact of Burlington on Hannibal well exposed on right side of road.
1.3	25.1	Quarry on right in Burlington Limestone.
1.2	26.3	Cross divide between Hill and Bay creeks. Cuts along highway show much residual chert from Burlington Limestone. The chert, being relatively insoluble, is left behind when the limestone weathers away.
1.0	27.3	STOP NO. 6. Outcrop of Burlington Limestone. The gradation from fresh limestone to red residual clay is well shown here. Although the Burlington is very pure, it contains a small content of insoluble clay which remains as a residual soil. A very small content of iron is responsible, when oxidized, for turning the clay a deep red. Excellent fossils are to be

found where weathering has etched out the surface of the limestone.

0.4 27.7 Cross bridge and pass onto flat flood plain of Bay Creek. This is built of alluvial sediments, probably deposited when the creek was a spillway for glacial waters from the Illinoian ice to the north. This portion of Bay Creek Valley is believed to have been cut before the Ice Age.

0.5 28.2 Cross Bay Creek and ascend to upland.

0.6 28.6 Stop on upland summit.
STOP NO. 7. Pennsylvanian sink hole fillings in Burlington Limestone.

The "Mississippian" sea that deposited the Burlington limestone remained more or less continuously in the region for some millions of years after the Burlington formation was deposited. As a consequence, many hundreds of feet of marine sediments were deposited on top of the Burlington.

This deposition ended when moderate movements in the earth's crust warped the layers into broad domes and depressions and raised the strata above the level of the sea. On this newly emergent land area, erosion set to work with the result that hundreds of feet of Mississippian strata were removed. Thus at this point, the Burlington was uncovered. Solution back some 235,000,000 years ago, as now, attacked the limestone and developed an uneven bedrock surface full of channels and sink holes.

There followed a renewed sinking of the region, causing the deposition chiefly of shale (mudstone) and sandstone deposits of Pennsylvanian (or "Coal Period") age. In the present outcrop, we see a deeply weathered old, pre-Pennsylvanian surface of the Burlington Limestone, the irregularities of which have been filled with Pennsylvanian shale and sandstone. Such a relationship geologists refer to as an unconformable contact. These latter strata have themselves been much disturbed by continued solution and collapse of the underlying limestone.

Well over 1,000 feet of Pennsylvanian strata were once present over all of this region above the Mississippian beds, just as they are still today in the rich coal and oil basin of central Illinois. Erosion through hundreds of millions of years since the days of coal formation have stripped all of this rock from Pike county except for thin, isolated patches, as at this place.

1.7 30.3 Descend steep hill. Note level summits of hills on both the Illinois and Missouri sides of the Mississippi, which rise to the old Calhoun peneplain level.

1.2	31.5	Enter NEBO.
0.5	32.0	Jog left and right at Standard-Shell stations in Nebo and continue ahead (W).
0.8	32.8	STOP NO. 8. To examine outcrops of Grassy Creek (Kinderhook) shale at roadside. The Grassy Creek shale is separated in this area from the Hannibal shale above by the thin Louisiana Limestone formation. Where the limestone is missing, the separation of the two shales is difficult to determine. The Grassy Creek shale is somewhat more slaty than the Hannibal shale and generally darker. It sometimes contains shiny, comb-like microscopic fossils, called "conodonts" and thought to be pavement teeth of tiny fish. Much controversy exists however, on this point.
2.4	35.2	Road descends to flood plain of the Mississippi. Knobby hills ahead are in Missouri.
2.5	37.7	STOP. Junction with Route 96. Turn right (N) on No.96.
0.1	37.8	Ledges of Louisiana Limestone at road level.
0.6	38.4	Enter PLEASANT HILL.
0.7	39.1	Ledges of Louisiana limestone.
1.2	40.3	Bridge over Sixmile Creek.
1.3-7		Numerous exposures of Hannibal shale capped by Burlington limestone. The soft Hannibal shale forms a steep slope below the protecting cap of the hard limestone.
0.4	40.7	Panhandle Eastern natural gas line booster-station on left.
0.6	41.3	STOP NO. 9. Ascend bluff by road to quarry. Numerous shallow exposures of Hannibal shale may be seen enroute. At quarry entrance, contact between Hannibal Shale and Burlington limestone is well exposed, and is conformable, as at Stop 4. Above the Burlington limestone is a considerable thickness of Pleistocene loess. Loess deposits are thickest on uplands immediately east of great rivers, like the Illinois and Mississippi, as a result of prevailing westerly winds that picked up the dust from the river flats and dropped a substantial part over the lee uplands. The greatest thicknesses of loess accumulated, not while the glacial ice was present nor during the much longer intervals between the four glacial periods (Nebraskan, Kansan, Illinoian,

Wisconsin), but at those times when glaciers either were advancing into the region or retreating from it.

It was at these times that the greatest quantity of water and sediment poured down the great valleys from glaciers upstream. It is quite likely that during summer seasons of heavy melting, the Mississippi rose in flood to fill its valley from side to side. At the approach of winter melting ceased, the valley floor was nearly dry, and great expanses of mud and sand were laid bare before the rising northwesterly gales, at lease until the coming of snow.

Because of the very angular character of the silt and clay particles which pack together to form "loess", such deposits have the remarkable faculty of standing with a vertical face, where marks or carvings may persist for many years. A common feature of loess is the inclusion of numerous shells of land snails, as well as the presence of tiny vertical tubes from rootlets of grasses long vanished through decay. Old soil zones and soil profiles, representing flourishing vegetation of interglacial stages, are useful in dividing and dating different levels in the loess deposits.

The fine view from the bluff top affords a panorama of Mississippi trough and the hill country of Missouri and Illinois that borders it. The glacial history of the Mississippi has already been discussed in connection with the story of the Illinois River. Before the Illinoian glaciation pushed the Mississippi westward, a large tributary of that stream is believed to have flowed through this valley, which was cut before the Ice Age. From 100 to 200 feet of sediments washed out from various glaciers of the past now partially fill the valley above its bedrock floor.

3.5 44.8 Stop sign; Route 24 in ATLAS.

END OF CONFERENCE

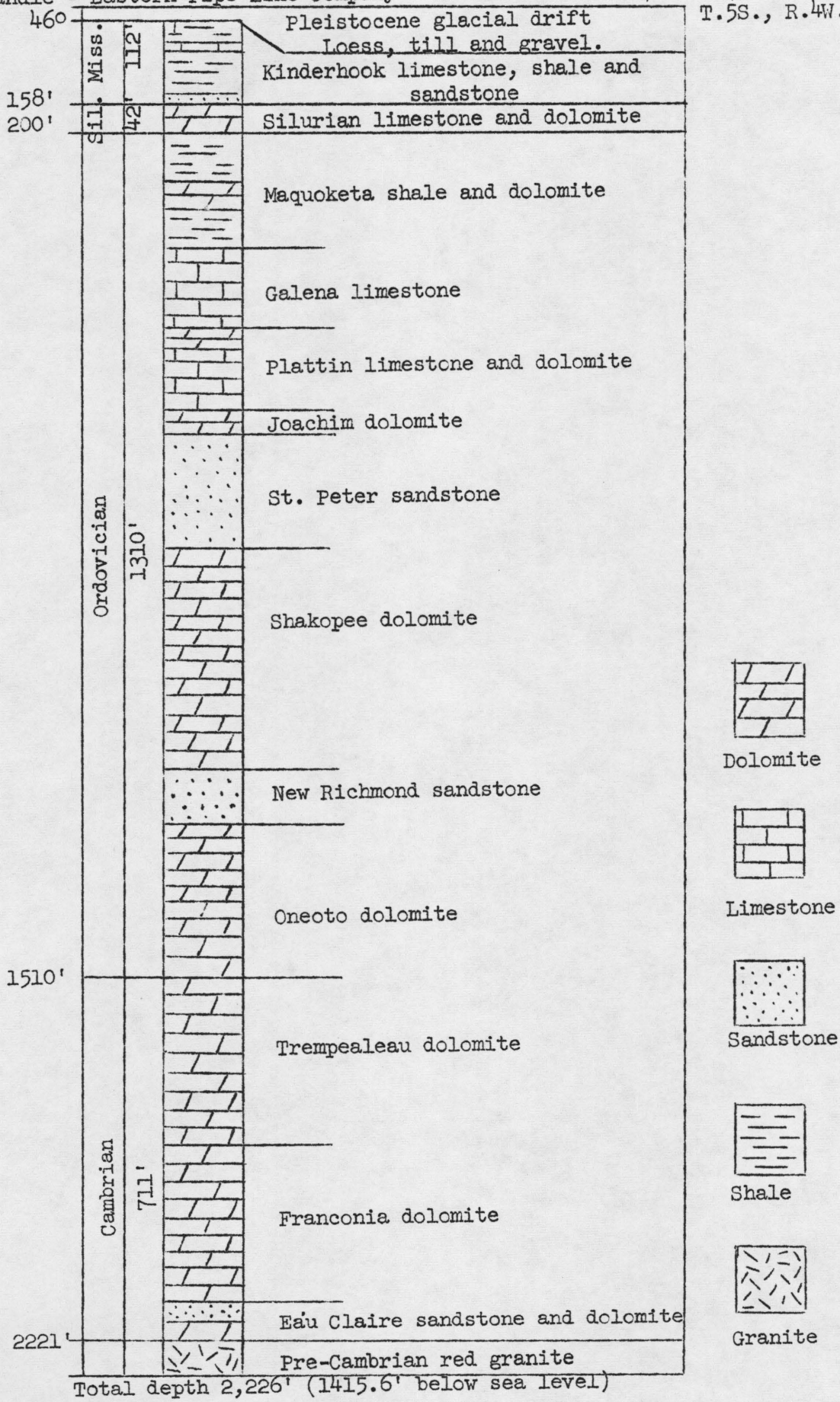
(Bon Voyage and Aufwiedersehen)

Turn right on Route 24 for Pittsfield. Continue ahead on Route 96 for Quincy.

GENERALIZED GEOLOGIC COLUMN
FOR THE PITTSFIELD AREA
Prepared by the Illinois State Geological Survey

ERAS		PERIODS	EPOCHS	FORMATIONS
Cenozoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Recent Post-glacial stage. Wisconsin glacial stage. Sangamon interglacial stage. Illinoian glacial stage. Yarmouth interglacial stage. Kansan glacial stage. Aftonian interglacial stage. Nebraskan glacial stage.
		Tertiary	Pliocene Miocene Oligocene Eocene	Stream gravels.
Mesozoic "Middle Life"	Age of Reptiles	Cretaceoue		Present in extreme southern Illinois only.
		Jurassic		Not present in Illinois.
		Triassic		Not present in Illinois.
Paleozoic "Ancient Life"	Age of Amphibians and Early Plants	Permian		Not present in Illinois.
		Pennsylvanian		Sandstones, siltstones, shales, clays, and coal beds.
		Mississippian	Upper	Not present in Pittsfield area.
			Lower	Warsaw limestone & shale. Burlington limestone. Kinderhook shale & limestone.
	Age of Fishes	Devonian		Probably absent in Pike County.
	Age of Invertebrates	Silurian		Limestone and dolomite in deep wells.
		Ordovician		Shales, limestone, dolomites and sandstones in deep wells.
		Cambrian		Dolomites, shales, and sandstones in deep wells.
Proterozoic Archeozoic		} referred to as "Pre-Cambrian" time.		Granite at bottom of two Pike County wells.

Oil test boring 3 miles west of
Pittsfield, Pike Co., Illinois
Panhandle - Eastern Pipe Line Company - Mumford No. 1 NE¼ of NW¼, Sec. 21, T.5S., R.4W.



Total depth 2,226' (1415.6' below sea level)

PART II. GEOLOGICAL HISTORY OF PIKE COUNTY

The geological story of the Pittsfield region falls naturally into four great chapters, embracing a time span of some two billion years, as follows:

1. The formation and final beveling of the "granite" foundation. Duration about 1,500,000,000 years.
2. The realm of the ancient seas - Formation of the bedrock layers. Duration about 250,000,000 years.
3. The lost "interval" of erosion. Duration about 250,000,000 years.
4. The Ice Age - Duration about 1,000,000 years.

1. The crystalline or granite foundation (or "basement"), on which the bedrock strata were laid down, comes to the surface in the St. Francis Mountains of Missouri and in the highlands surrounding Lake Superior. In Pike County, two deep wells have encountered this same granite foundation at depths of 2,226 feet and 3,207 feet, or well below sea level.

Some of the basement rocks were once sandstone or shale -- others, in a molten state, poured out over the surface lava or slowly crystallized deep underground to form granite or gabbro. Great mountain-making disturbances in the earth's crust twisted and shattered these early rocks, causing much of the material to be remelted, compressed, and recrystallized to form different, more compact kinds of rock.

Between periods of great disturbance were long intervals of great quiet, when erosion beveled the mountain summits down to a nearly flat plain.

The last of these periods of extensive erosion and beveling took place just before the inundation by the ancient seas of the Paleozoic. This final erosion left a fairly flat plain over much of the country, but in local areas masses of very hard rock were left behind as hills or low mountains. A deep well drilled a few miles west of Pittsfield struck a granite peak standing nearly 1,000 feet above the granite surface found by a well nine miles northwest. Such irregularities are, however, unusual.

2. The Cambrian sea was the first to bring preservable types of life to the region, and marks the beginning of a long period of time (the Paleozoic Era) when Illinois was much of the time beneath the waters of of seas that invaded the continent's interior. It was during this era that the layers of bedrock limestone, shale, and sandstone were laid down as sediment on the bottom of the sea. Late in the Paleozoic Era, during the Pennsylvanian Period, layers of coal were also formed, presumably in great swamps close to sea level. The coal-bearing strata once extended across the Pittsfield region, but were worn away during the long period of erosion that marks the "lost interval" in Illinois.

3. After the Coal Period, over 200 million years ago, the seas withdrew and there is no evidence that they again covered this part of Illinois. Instead, the region was raised a moderate distance above sea level, and streams and weathering agencies set to work to strip away the rocks, layer by layer. The debris of this erosion process was carried off to lower regions to be deposited as new sediments that would some day harden into rock strata. Thus through the days of the dinosaurs and of all the odd and primitive mammals that followed them onto the scene, we have no record of the nature of life here in Illinois. We know only that erosion laid bare the Mississippian limestones and shale that once were buried beneath the coal strata, and that streams cut deep valleys into the bedrock.

4. About a million years ago, climatic conditions permitted the accumulation of great ice masses at the poles and caused them to move as continental glaciers down into our present temperate zone. Climate during the ice age fluctuated so that mild intervals of hundreds of thousands of years in duration intervened between stages of glacial advance.

Thus we can divide the Pleistocene, or Ice Age, according to four major glacial advances, the Nebraskan, Kansan, Illinoian, and Wisconsin glacial stages. Of these only the middle two are known to have crossed the Pittsfield region. The last or Wisconsin glaciation did not extend this far southwest, but the waters from its melting seriously effected the Mississippi and Illinois Rivers, which also indirectly contributed the loess that is so vital a factor in the fertility of our uplands.

SUGGESTED REFERENCES

Krey, Frank, "Structural Reconnaissance of the Mississippi Valley Area from Old Monroe Missouri to Nauvoo, Illinois," Ill. Geol. Surv., Bull. 45.

Horberg, Leland, "Bedrock Topography of Illinois," Ill. Geol. Surv., Bull. 73.